Claims

What is claimed is:

1. An isolated polynucleotide comprising a coding sequence for a CZF-1 protein or a variant thereof, wherein the CZF-1 protein variant comprises an amino acid sequence at least 90% identical to SEQ ID. NO. 2.

2. The isolated polynucleotide of claim 1 wherein the CZF-1 protein variant comprises a sequence which is at least 95% identical to SEQ ID NO. 2.

3. The isolated polynucleotide of claim 1 wherein the CZF-1 protein variant comprises a sequence which is at least 97% identical to SEQ ID NO. 2.

4. The isolated polynucleotide of claim 2, wherein the CZF-1 protein variant is immunoreactive with an antibody produced by immunizing an animal with a protein comprising the amino acid sequence set forth in SEQ ID NO. 2.

5. The isolated polynucleotide of claim 1, wherein said polynucleotide comprises a sequence which hybridizes under highly stringent conditions to SEQ ID NO. 1.

6. The isolated polynucleotide of claim 1, wherein the CZF-1 protein comprises the amino acid sequence of SEQ ID NO. 2.

7. An isolated polynucleotide selected from the group consisting of:

(a) a polynucleotide comprising a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 193 through nucleotide 2346 of SEQ ID. NO. 1;

(b) a polynucleotide comprising a sequence which is complementary to a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 193 through nucleotide 2346 of SEQ ID. NO. 1;

(c) a polynucleotide comprising a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 476 through nucleotide 939 of SEQ ID. NO. 1; and

(d) a polynucleotide comprising a sequence which is complementary to a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 476 through nucleotide 939 of SEQ ID. NO. 1.

8. An isolated polynucleotide comprising a coding sequence for a CZF-2 protein or a variant thereof, wherein the CZF-2 protein variant comprises an amino acid sequence at least 90% identical to SEQ ID. NO. 4.

9. The isolated polynucleotide of claim 1 wherein the CZF-2 protein variant comprises a sequence which is at least 95% identical to SEQ ID NO. 4.

10. The isolated polynucleotide of claim 8 wherein the CZF-2 protein variant comprises a sequence which is at least 97% identical to SEQ ID NO. 4.

11. The isolated polynucleotide of claim 9, wherein the CZF-2 protein variant is immunoreactive with an antibody produced by immunizing an animal with a protein comprising the amino acid sequence set forth in SEQ ID NO. 4.

12. The isolated polynucleotide of claim 8, wherein said polynucleotide comprises a sequence which hybridizes under highly stringent conditions to SEQ ID NO. 3.

13. The isolated polynucleotide of claim 8, wherein the CZF-2 protein comprises the amino acid sequence of SEQ ID NO. 4.

14. An isolated polynucleotide selected from the group consisting of:

(a) an isolated polynucleotide comprising a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 25 through nucleotide 1581 of SEQ ID. NO. 3;

(b) an isolated polynucleotide comprising a sequence which is complementary to a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 25 through nucleotide 1581 of SEQ ID. NO. 3;

(c) an isolated polynucleotide comprising a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 163 through nucleotide 423 of SEQ ID. NO. 3; and

(d) an isolated polynucleotide comprising a sequence which is complementary to a sequence which hybridizes under highly stringent conditions to a sequence comprising, consecutively, nucleotide 163 through nucleotide 423 of SEQ ID. NO. 3.

15. An isolated CZF-1 protein or a variant thereof, wherein the CZF-1 protein variant comprises an amino acid sequence at least 90% identical to SEQ ID. NO. 2;

16. The isolated protein of claim 15, wherein the CZF-1 protein variant comprises a sequence which is at least 95% identical to SEQ ID NO. 2.

17. The isolated protein of claim 15, wherein the CZF-1 protein variant comprises a sequence which is at least 97% identical to SEQ ID NO. 2.

18. The isolated protein of claim 15, wherein the CZF-1 protein variant is immunoreactive with an antibody produced by immunizing an animal with a protein comprising the amino acid sequence set forth in SEQ ID NO. 2.

19. The isolated protein of claim 15, wherein the CZF-1 protein comprises the amino acid sequence of SEQ ID NO. 2.

20. The isolated of protein of claim 15, wherein the protein is a fusion protein and comprises from 1-200 amino acids at the amino terminus or carboxy terminus of SEQ ID NO. 2.

21. An isolated CZF-2 protein or a variant thereof, wherein the CZF-1 protein variant comprises an amino acid sequence at least 90% identical to SEQ ID. NO. 4.

22. The isolated protein of claim 21, wherein the CZF-2 protein variant comprises a sequence which is at least 95% identical to SEQ ID NO. 4.

23. The isolated protein of claim 21, wherein the CZF-2 protein variant comprises a sequence which is at least 97% identical to SEQ ID NO. 4.

24. The isolated protein of claim 21, wherein the CZF-2 protein variant is immunoreactive with an antibody produced by immunizing an animal with a protein comprising the amino acid sequence set forth in SEQ ID NO. 4.

25. The isolated protein of claim 21, wherein the CZF-1 protein comprises the amino acid sequence of SEQ ID NO. 4.

26. The isolated of protein of claim 21, wherein the protein is a fusion protein and comprises from 1-200 amino acids at the amino terminus or carboxy terminus of SEQ ID NO. 4.

27. An antibody which is immunoreactive with a protein comprising the amino acid sequence of SEQ. ID NO. 2.

28. An antibody which is immunoreactive with a protein comprising the amino acid sequence of SEQ ID NO. 4.

29. A method of determining the extent of chondrogenesis in a cell, comprising

(a) contacting said cell or RNA isolated from said cell with a nucleic acid probe said nucleic acid probe comprising a sequence selected from the group consisting of the coding sequence of SEQ ID NO. 1, a fragment of the SEQ ID NO. 1 coding sequence, the coding sequence of SEQ ID NO. 3, and a fragment of the SEQ ID NO. 3 coding sequence; and

(b) assaying for the presence of a hybridization product between the nucleic acid probe and said RNA.

30. The method of claim 29 wherein the fragment comprises nucleotide 476 through nucleotide 939 of SEQ ID NO. 1.

31. The method of claim 29 wherein the fragment comprises nucleotide 163 through nucleotide 423 of SEQ ID NO. 3.

32. A method of determining the extent of chondrogenesis in a cell, comprising

(a) contacting said cell or protein obtained from said cell with an anti-CZF-1 protein antibody, wherein said protein comprises t he amino acid sequence of SEQ ID NO. 2, or

(b) contacting said cell or protein obtained from said cell with an anti-CZF-2 protein antibody, wherein said protein comprises the amino acid sequence of SEQ ID NO. 4.

33. A method of ascertaining the presence of cells having characteristics of chondrocytes, in a tissue sample obtained from a tissue or fracture callus, comprising

(a) contacting said tissue sample, or RNA isolated from said tissue sample, with a nucleic acid probe, said nucleic acid probe comprising a sequence selected from the group consisting of the coding sequence of SEQ ID NO. 1, a fragment of the SEQ ID NO. 1 coding sequence, the coding sequence of SEQ ID NO. 3, and a fragment of the SEQ ID NO. 3 coding sequence; and

(b) assaying for the presence of a hybridization product between the nucleic acid probe and said RNA.

34. A method of ascertaining the presence of cells having characteristics of chondrocytes, in a tissue sample obtained from a tumor or fracture callus, comprising

(a) contacting said tissue sample, or protein obtained from said tissue sample, with an anti-CZF-1 protein antibody, wherein said protein comprises the amino acid sequence of SEQ ID NO. 2, or

(b) contacting said tissue sample, or protein obtained from said tissue sample, with an anti-CZF-2 protein antibody, wherein said protein comprises the amino acid sequence of SEQ ID NO. 4.